# MECHANICALLY STABILIZED EARTH RETAINING WALL FOR NY170 NELSONVILLE TOWER NELSONVILLE, NEW YORK



**VICINITY MAP** 





SHEET INDEX			
SHEET NUMBER	SHEET DESCRIPTION		
RW-1	COVER SHEET	F	
RW-2	TECHNICAL SCOPE OF WORK	D	
RW-3	SITE PLAN	A S	
RW-4	WALL PROFILE & TYPICAL SECTION	D J	
RW-5	WALL CONSTRUCTION DETAILS	S	

#### **SECTION 1: GENERAL TECHNICAL NOTES**

#### 1.01 <u>Description:</u>

The work shall consist of furnishing and constructing permanent galvanized welded wire baskets and Miragrid Geogrid retaining wall systems in accordance with this technical scope of work and in reasonably close conformity with the lines, grades, and dimensions shown on the Site Grading, Utilities and Erosion & Sediment Control Plan for Homeland Towers Nelsonville (NY170), by JMC Planning, Engineering, Landscape Architecture & B. Land Surveying, PLLC, Sheet No.CD-5, Project No. 16237, dated 03/13/2020.

#### 1.02 Work Included:

- Furnishing galvanized steel welded wire basket facing units as shown on the construction drawings.
- Furnishing Miragrid structural geogrid reinforcement as shown on the construction
- Furnishing Miramesh GR face wrap or approved equivalent, inside the welded wire baskets as shown on the construction drawings.
- Storing, cutting and placing structural geogrid reinforcement as specified herein
- Excavation, placement and compaction of unit wall fill and backfill material as specified herein and as shown on the construction drawings.
- Erection of galvanized welded wire basket facing units and placement of structural geogrid.

#### 1.03 Reference Documents:

- American Association of State Highway and Transportation Officials (AASHTO) T-99 Moisture-Density Relations of Soils Using a 5.5 Pound Rammer in a 12-
- T-180 Moisture-Density Relations of Soils Using a 10 Pound Rammer in a 18inch Drop
- American Society for Testing and Materials Standards (ASTM)

and as shown on the construction drawings.

- C-33 Specification for Concrete Aggregates C-140 Methods of Sampling and Testing Concrete Masonry Units
- C-150 Specification for Portland Cement
- C-1372 Standard Specifications for Segmental Retaining Wall Units
- D-422 Method for Particle Size Analysis of Soils D-698 Method for Laboratory Compaction Characteristics of Soils Using
- Standard Effort
- D-732 Shear Strength of Plastic by the Punch Tool Method D-790 Flexural Properties Testing of Plastic
- D-1557 Method for Laboratory Compaction Characteristics of Soils Using
- Modified Effort D-1556 Method for Density and Unit Weight of Soil in-Place by the Sand Cone
- D-6938 Methods for In-Place Density and Water Content of Soil and Soil-
- Aggregate by Nuclear Methods D-4253 Methods for Maximum Index Density and Unit Weight of Soils Using a
- Vibratory Table D-4254 Methods for Minimum Index Density and Unit Weight of Soils and
- Calculation of Relative Density D-4595 Tensile Properties of Geotextiles by The Wide-Width Strip Method
- D6637 Standard Test Method for Determining Tensile Properties of Geogrids by the Single or Multi-Rib Tensile Method
- D6706 Standard Test Method for Measuring Geosynthetic Pullout Resistance in

#### National Concrete Masonry Association (NCMA) NCMA Design Manual for Segmental Retaining Walls

- JMC Planning, Engineering, Landscape Architecture & Land Surveying, PLLC, Site Grading, Utilities and Erosion & Sediment Control Plan, Homeland Towers Nelsonville (NY170), Sheet No. CD-5, Project No. 16237, dated 03/13/2020.
- Terracon Consultants-NY, Inc., Geotechnical Engineering Report, NY170 Nelsonville Tower, Project No. J5205013, Dated March 9, 2020.
- Where specifications and reference documents conflict, the Engineer shall make final determination of the applicable document

## 1.04 Special Provisions:

- The designs presented herein are based on wall profiles, soil parameters, foundation conditions and loadings stated in documentation as outlined in Section 1.03, Items C and D, and Section 4.01.
- The reinforced backfill to be used in the wall construction must meet specific engineering requirements as outlined in this Technical Scope of Work. The suitability of on-site materials for use in the MSE wall construction, as specified herein, should be determined prior to construction.
- The Contractor shall be responsible for the cost of all means of subsoil improvement; cost of additional subsoil exploration; and for all labor tools, equipment and incidentals necessary to complete the work.
- The Contractor shall be responsible for complying with all federal, state and local requirements for execution of the work, including local building inspection and current OSHA excavation regulations.
- Prior to undertaking any grading or excavation of the site, the Contractor shall confirm the location of proposed retaining wall and all underground features, including utility locations within the area of construction.
- All work undertaken in the construction of the retaining wall are subject to the quality control/assurance and special inspection provisions outlined in Section
- Where there is potential for conflict between geogrids and other construction on the project, Terracon should be afforded the opportunity to review construction documents and make a determination on the appropriate course of action. Under no circumstance should geogrid reinforcement be cut or severed unless otherwise explicitly indicated by these construction documents. Any severing of the geogrid performed without the recommendation of Terracon shall be repaired at no cost to the Terracon or the Owner.
- Terracon has completed engineering design of the proposed retaining walls, including internal stability and local external stability where applicable, based upon the information provided to us as outlined above...
- Any changes in planned grading, locations of structures or changes in wall profiles should be brought to the attention of Terracon for modification of the wall designs as necessary.
- Verify all dimensions and grades prior to wall construction.

#### **SECTION 2: MATERIALS**

### 2.01 <u>Definitions:</u>

- Structural Geogrid a Mirafi geogrid formed by a regular network of integrally connected tensile elements with apertures of sufficient size to allow interlocking with surrounding soil, rock, or earth and function primarily as reinforcement.
- Face Wrap a UV resistant Mirafi geosynthetic composed of high-tenacity monofilament polypropylene yarns that are woven together to produce an open mesh geotextile.
- Welded Wire Basket Facing Units a W4.0 galvanized steel wire mesh formed in a configuration to provide a facing during the wall construction.
- Drainage Gravel granular fill which is within and directly behind the welded wire basket facing units.
- Reinforced Backfill compacted soil which is within the reinforced soil volume as outlined on the plans
- Retained Backfill compacted soil which is retained beyond the reinforced soil
- Foundation Soil compacted or in-situ soil beneath the entire wall.
- Engineer Terracon Consultants, Inc.

zone as outlined on the plans.

Geotechnical Engineer - Geotechnical Engineer of Record

#### 2.02 Structural Geogrids:

- The geogrids shall be Mirafi structural geogrid as shown on the plans, or geogrid of equivalent long-term strength with the segmental concrete facing, consisting of regular grid structure of high tenacity polyester multifilament yarns woven in tension and finished with PVC coating.
- The manufacturer shall provide the certification that the ultimate strength of the geogrid as per ASTM D6637 is equal to or greater than the ultimate strength called for on the drawings.

Geogrid Type - Miragrid	Ultimate Strength (lb./ft)	Long Term Design Strength (lb./ft)
3XT	3500 plf	1768 plf

## 2.03 Geotextiles:

- The geotextile shall be Mirafi 160N as shown on the plans, or equivalent, consisting of spun-bound 100% continuous filament polyester needle punched engineering fabric.
- The minimum physical properties of the geotextile will include the following:
- Tensile Strength (ASTM D4632) 160 lbs. Burst Strength (ASTM D3786) - 305 psi.
  - Puncture Strength (ASTM D4833) 95 lbs
- Permittivity (ASTM D4491) 1.4/sec Permeability (ASTM D4491) - .22 cm/sec

#### 2.04 Face Wrap:

- The face wrap shall be a Miramesh GR geosynthetic as shown on the plans, or geosynthetic of equivalent long-term design strength, aperture size and UV resistant, consisting of regular grid structure of high tenacity monofilament polypropylene yarns that are woven together to produce an open mesh face.
- The manufacturer shall provide the certification that the ultimate strength of the geosynthetic as per ASTM D4595 is equal to or greater than the ultimate strength called for on the drawings.

Geogrid	Ultimate Strength		Long Ten	_
Type -	(lb./ft)		Strengt	
Miramesh	<b>MD</b>	<b>CD</b>	<b>MD</b>	<b>CD</b>
GR	1440 plf	1733 plf	407 plf	490 plf

## 2.05 Welded Wire Basket Facing Units:

- Welded wire basket forms shall be fabricated from W4.0x4.0 welded wire fabric with 4 inch by 4 inch openings conforming to AASHTO M-55.
- Welded wire baskets shall be constructed into the configuration shown on the plans. Each bend will be placed midway between adjoining transverse wires.
- Galvanize at 1 oz per square foot minimum and provide a tensile strength of C. 60,000 psi minimum. Galvanize all wire according to ASTM A641. Any bends made in the welded wire fabric after galvanization shall be checked for adequate galvanization coating.
- The top of each basket shall be that required to form the appropriate slope face angle with a minimum of 2 inches of overlap to the adjoining form above and to maintain a net vertical face height of 18 inches; the horizontal leg shall be a minimum of 20 inches in length, and each form shall be 10 feet long.
- Wire strut supports shall be provided for each basket and shall be placed at a maximum of 2 feet on center in the configuration shown on the plans. A minimum of 6 struts shall be required per basket course (based on 10 ft long baskets). Each strut end shall be cold bent to form a hook approximately one inch in length.

## Drainage Face Rock:

Drainage gravel shall consist of clean 1½" minus free-draining well graded crushed stone or granular fill, meeting the requirements of the following gradation tested in accordance with ASTM D-422:

Sieve Size	Percent Passing		
1½ inch	100		
1 inch	95-100		
1/2 inch			
No. 4	0 – 10		
No. 8	0 – 5		

Drainage gravel shall be placed behind the front face of the welded wire basket units as indicated on the design drawings. Not less than 1.3 cubic foot (0.036 m3), of drainage gravel shall be used for each square foot (0.093 m2) of wall face unless otherwise specified.

## 2.07 Reinforced Backfill:

Reinforced backfill shall consist of suitable granular materials meeting the following gradation as determined in accordance with ASTM D-422:

Sieve Size	Percent Passing
4 inch	100
No. 4	20 - 100
	0 - 60
	0 - 25

## The plasticity index of the fine fraction shall be less than 15.

- If hand compaction methods are utilized in any portion of the wall backfill, the maximum particle size shall be limited to 3-inches.
- USCS soil types CL, CH, ML, or MH shall not be used in any portion of the wall
- backfill including retained materials placed beyond the reinforced zones. All reinforced backfill materials shall also have the minimum engineering
- All backfill materials, whether on-site or imported, shall be approved by the Engineer prior to construction.
- Test results of all proposed backfill materials, whether on-site or imported, shall be submitted to the Engineer for approval prior to construction.

#### 2.08 Post Foundation System:

- Post foundation system used for handrail/fence post shall be a polypropylene sleeve such as Sleeve-It™ SD-1.
- The Sleeve-It™ SD-1 product shall be evenly spaced no farther apart than 8 feet
- Use of the Sleeve-It™ SD-1 system is limited to the following fencing applications without consideration of wind loading:
  - 8-foot high and under chain link fences

properties shown in Section 4.01, Item A.

- 6-foot high and under wood fence with gaps between boards
- 6-foot high and under balustrade PVC, steel, aluminum or wrought iron
- For other fencing systems not meeting the criteria above, contact the Sleeve-It™ system manufacturer to determine suitability.

#### 2.09 <u>Delivery, Storage, Handling:</u>

- Structural Geogrid, Face Wrap and Geotextiles
  - Contractor shall check to ensure that the proper materials have been received upon delivery.
  - All geogrids and geotextiles shall be stored above -20°F (-29°C).
  - Contractor shall prevent excessive mud, wet cement, epoxy, and like material which may affix themselves to the gridwork, from coming in contact with the geogrid material.
  - Rolled geogrid material may be laid flat or stood on end for storage.
  - Geogrids shall be stored according to manufacturer's recommendations.

## Welded Wire Basket Facing Units

- Contractor shall check the units upon delivery to ensure that proper materials have been received.
- Contractor shall prevent excessive mud, wet cement, epoxy, and like materials from coming in contact with and affixing to the units.
- Welded wire baskets shall be stacked horizontally versus being stood on

## **SECTION 3: EXECUTION**

## 3.01 Construction:

- The excavation shall be carried to the lines and grades shown on the construction drawings and to the extent necessary to place structural geogrid at the required embedment lengths. Contractor shall be careful not to disturb base or existing soils/fills beyond the lines shown except for that necessary to comply with applicable safety regulations.
- Excavations will be made in a manner which will not disturb the existing construction on the site. Contractor will provide protection or will construct the walls in such a manner to maintain the integrity of existing improvements during E. construction.
- In-situ materials excavated from the location of the retaining walls shall be stockpiled on-site at locations designated by the Owner and in locations which will not interfere with the execution of the work.

## 3.02 Subgrade Preparation:

Subgrade shall be excavated as required for placement of the leveling pad as

shown on the construction drawings, or as directed by the Geotechnical Engineer.

- Subgrade shall be examined by the Geotechnical Engineer to confirm that the actual foundation conditions meet or exceed design assumptions. As a minimum, soil shall be proof-rolled before construction proceeds. Subgrade conditions not meeting the required strength shall be removed and replaced with acceptable material.
- Over-excavated areas shall be replaced with compacted granular backfill material or soils approved by the Geotechnical Engineer to the lines and grade shown on the construction drawings.
- Granular backfill shall be placed in loose lifts not exceeding 10 inches in thickness, compacted to a minimum of 95 percent of the maximum density as determined by AASHTO T-99 or ASTM D-698. The moisture content of the backfill prior to, and during compaction shall be uniformly distributed throughout each layer and shall be within a range of 2% below, to 2% above optimum

## 3.03 Welded Wire Basket Facing Unit Installation:

- Welded wire baskets shall be placed beginning on the approved subgrade soil surface.
- Baskets shall be placed inside each other along the horizontal length of the wall with a minimum of two inches of inset. Stagger vertical joints in subsequent overlying forms by a minimum of two feet.
- The face of each basket shall be placed on top of the basket immediately

As required, the uppermost basket course at the top of the wall shall be adjusted

Welded wire baskets installed at locations where the top of wall steps down in elevation shall be cut to match the existing wall geometry as shown, galvanize cut ends in the field where baskets are cut to match the existing wall geometry. The

in order to match proposed finished grade at the top of the wall.

wire baskets shall be bent into the reinforced zone at basket elevation steps as

## 3.04 Structural Geogrid Installation:

- Geogrid shall be oriented with the highest strength axis perpendicular to the wall
- Geogrid reinforcement shall be placed at the elevation(s) and to the extent(s)
- shown on the construction drawings or as directed by the Engineer The geogrid soil reinforcement shall be laid horizontally on compacted backfill. The geogrid shall be pulled taut and anchored prior to backfill placement on the

geogrid. No tensioning of the geogrid materials shall be required.

- Geogrid reinforcements shall be continuous throughout their embedment length(s). Spliced connections between shorter pieces of geogrid will not be allowed unless pre-approved by the Engineer prior to construction.
- Tracked construction equipment shall not be operated directly upon the geogrid reinforcement. A minimum fill thickness of 6 inches is required prior to operation of tracked vehicles over the geogrid. Tracked vehicle turning should be kept to a minimum to prevent tracks from displacing the fill and damaging the geogrid.
- No changes to geogrid layout, including, but not limited to, length, geogrid type, or elevation, shall be made without the approval of the Engineer.

## 3.05 Post Foundation System Installation:

- Place the Sleeve-It™ SD-1 Systems at locations of fence posts or railings supports at a maximum spacing of 8 feet on centers.
- Assemble and Install Sleeve-It™ SD-1 Systems per manufacturer's recommendations.
- Prepare a level area approximately 24" wide by 36" deep behind the wall face. The prepared area should be 24" below the proposed top of wall not including the cap stone.
- Place the Sleeve-It™ unit on the level surface in an upright position with the front edge of the unit flush against the back of the wall. Multiple units should be spaced in accordance with fence specifications no longer than 8 feet on centers.
- Encapsulate and stabilize the Sleeve-It™ unit by placing and compacting sufficient backfill material layers as required. Slit the geogrid perpendicular to the wall face just enough to fit around the base of the unit while ensuring the geogrid remains properly attached to the wall. Continue the backfilling process until the material reaches the top of the tower. Do not remove the perforated lid until ready to place post. Do not step on perforated lid, as this could cause serious bodily injury.
- Punch the perforated lid using a mallet or hammer to expose the inside of the Sleeve-It™ unit. Detached lids can be left inside the unit or discarded prior to pouring the infill material.
- Place post through the exposed area and rest of the flat ground suface area inside the Sleeve-It™ cavity. Ensure that the post is upright and level and hold in place while carefully pouring infill material such as concrete through the exposed cavity. Follow guidelines as specified by infill supplier. Concrete is highly recommended as infill material.

## Reinforced Backfill Placement:

- Reinforced backfill shall be placed, spread, and compacted in such a manner that minimizes the development of slack in the geogrid.
- Reinforced backfill shall be placed and compacted in lifts not to exceed 6 inches where hand compaction is used, or 8-10 inches where heavy mechanical compaction equipment is used.
- Reinforced backfill shall be compacted to a minimum of 95 percent of the maximum density as determined by AASHTO 1-99 or ASTM D-698. The moisture content of the backfill material prior to and during compaction shall be uniformly distributed throughout each layer and shall be within a range of 2% below, to 2% above optimum moisture content. If a well-defined maximum density curve cannot be generated by impact compaction in the laboratory, the backfill shall be compacted to a minimum of 70 percent of relative density as determined by ASTM D-4253 and D-4254.
- Reinforced backfill shall be compacted in all areas to the lines and grades shown on the plans including all sloped areas above.
- Only lightweight hand-operated compaction equipment shall be allowed within 4 feet of the face of the wall.

## 3.07 Site Drainage:

- At the end of each day's operation, the Contractor shall slope the last lift of reinforced backfill away from the wall facing to rapidly direct runoff away from the
- wall face. The Contractor shall not allow surface runoff from adjacent areas to enter the wall construction site.
- Finished grading at the top of the wall should provide positive drainage away from the retaining wall system to prevent infiltration of water into retained soils which

## may increase lateral pressures on the structure. 3.08 Quality Assurance:

- Quality Assurance and Special Inspection for the project, shall be conducted in accordance with the applicable portions of the Uniform Building Code, International Building Code and the Building Construction and Safety Code,
- NFPA 5000, or as required by the governing building department.

All Special Inspectors shall be under the supervision of a registered engineer.

Testing and inspection services shall be performed only by trained and

the qualifications of all special inspectors shall be reviewed and approved by the

- experienced personnel and experienced technicians currently qualified for the work they are to perform. If Special Inspection is provided by anyone other than the Engineer of Record,
- Engineer of Record. All work requiring Special Inspection shall be made available and remain accessible and exposed until it is observed by the Special Inspector.

## Duties of the Special Inspector:

- The Special Inspector shall observe the work requiring special inspection for conformance with the approved design drawings and specifications.
- The Special Inspector shall furnish inspection reports to be kept at the site for use by the Building Official, the Contractor and the Engineer of Record. If Special Inspection is provided by anyone other than the Engineer of Record, reports shall be submitted to the office of the Engineer of Record on a weekly basis. All discrepancies shall be brought

- to the attention of the Contractor for correction, then if uncorrected, to the design authority and the Building official.
- Upon completion of the assigned work, the Special Inspector shall complete and sign a final report certifying that to the best of his knowledge, the work is in conformance with the approved plans and specifications, and the applicable workmanship provisions of the code.
- If testing services are provided by anyone other than the Engineer of Record, reports shall be submitted to the office of the Engineer of Record on a weekly basis.
- The following Special Inspection Schedule provides the types, extents and frequency of specific items requiring special inspections and structural tests as part of this project:

Frequency

SPECIAL INSPECTION SCHEDULE

SPECIAL CASES (17	(05.1)		
Geogrid, Face Wrap and Geotextiles	X		Special Inspection shall be made of the type, location, orientation and extent of geogrid and geotextile placement in each wall.
Welded Wire Basket	х		Special inspection shall be made of the wire baskets to verify dimensions, strut placement, basket inset and vertical and horizontal offsets as required by the design
SOILS (1705.6)		,	-
Excavations		х	Verify excavations are extended to proper depth and have reached proper material.
Field Density		X	In accordance with ASTM D-6938 or ASTM D-1556.  • Subgrade – One test every 500 to 1000 square feet of subgrade area.  • Reinforced Backfill – One test every 500 to 1000 square feet of backfill per lift.
Moisture- Density Relationships		х	In accordance with AASHTO or ASTM criteria as specified for subgrade and reinforced backfill.
Gradation Analysis		X	In accordance with ASTM D-422.  • Drainage Face Rock — One test every 500 cubic yards of material.  • Wall Backfill — One test every 500 cubic yards of material.
Wall Backfill	х		Verify use of proper materials, densities and lift thickness during placement and compaction of reinforced backfill.

## SECTION 4: DESIGN NOTES FOR RETAINING WALL SYSTEM

# 4.01 Design Parameters:

Wall Segment	<u>Friction</u> <u>Angle</u>	Cohesion	<u>Unit</u> Weight
Reinf.	32°	0 psf	120 pcf
Backfill Ret. Backfill	32°	0 psf	120 pcf

Minimum Factor of Safety on Geogrid Strength Minimum Factor of Safety on Geogrid Pullout. .. 1.5 Percent Coverage of Geogrid.. .100% External Stability Minimum Factor of Safety Against Base Sliding.

Minimum Factor of Safety (Global Stability). .. 1.5 Uniform Surcharge (Traffic). . 250 psf D. Factor of Safety Seismic Conditions .

material stockpiles, equipment pad, and structures.

Seismic Acceleration Coefficient (A).

# Design of the reinforced soil structure is based on the following parameters:

120 pcf

Internal Stability of Walls Minimum Factor of Safety Against Overturning .. 2.0

.. 0.75xStatic FS Hydrostatic Loading. None

This wall was designed with a uniform live load surcharge of 250 psf only. No

other temporary or permanent loads shall be permitted within 2H of the retaining

wall. These loads include but are not limited to, construction equipment, cranes,

. 0.189g

MO M

ONVILI K LEDGE F

S S

NEL 15 RO

0

RW-2 DESIGNED BY: BJD
DRAWN BY: PPS
APPVD. BY: DRC/MAF SCALE: AS SHOWN 4/24/2020 IOB NO. J5205102 ACAD NO. 2 RW-2 SHEET NO.: 2 OF 5





